NRC·CNRC
Institute for Research in Construction

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construction innovation

NRC's green and gold building

The new NRC-IFCI building is in the running for gold certification for Leadership in Energy and Environmental Design (LEED), a benchmark for environmentally friendly buildings.

With its new $20 million headquarters on the University of British Columbia campus, the NRC Institute for Fuel Cell Innovation (NRC-IFCI) puts its facility where its values are. The building is a living laboratory, in which "green" technologies that rely on fuel cell and hydrogen advances are not only researched—they're also incorporated into the building's design and construction. At work in a functioning building, the technologies give valuable insights into how they function under real-life conditions, as well as the regulatory steps that must be taken before they can be put into wider use.

A good example of a new environmental technology at work is the building-wide system of photovoltaic cells installed in skylights, roofs and walls. These cells power a hydrogen electrolyzer, which separates water into hydrogen and oxygen. The hydrogen produced by this system is being tested to determine if it can be used for laboratory experiments, as well as for combustion applications in engines and other systems. In addition, researchers are studying the potential value of storing hydrogen in photovoltaic applications as an alternative to batteries and stored electricity. If this work pans out, they plan to use the system's hydrogen to run a fuel cell back-up power system for the building's cell phone booster station.

The use of a 5KW solid-oxide fuel cell inside the building to provide heat and electricity is another technology that's being evaluated. The fuel cell is working in tandem with ground source heat pumps, transferring the heat produced to floor heating coils. This interconnected approach allows an excellent opportunity to study the effectiveness of the fuel cell heating system in various energy demand scenarios.

The inclusion of an external hydrogen distribution system in the building's infrastructure is also worth a mention. This external pipeline runs the entire length of the building and delivers a variety of research gases to the labs. Because most of these gases are combustible, the external delivery system is safer. It's also much more flexible for adding further piping and connecting new equipment as tenant and research requirements evolve. This system has worked so well that it may prove a viable future approach for supplying hydrogen in small and large research buildings.

Beyond allowing researchers to observe the building-integrated technologies at work in real-life conditions, however, the facility also serves as a testing ground for the best ways to install and integrate them. For example, many fuel cell appliances do not have installation codes and standards governing building-integrated applications. To begin the code development process, NRC-IFCI's Demonstration Program is using sound engineering principles to install the indoor fuel cell. They will then use the lessons learned to educate code officials and cooperate with them to remove regulatory barriers to these new sustainable technology alternatives.

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Read *Construction Innovation* on the Web at **http://irc.nrc-cnrc.gc.ca/ci**

National Research Council Canada
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Canada

Construction codes

Commission sets priorities for the 2010 National Model Codes

In developing the 2010 National Model Codes, the Canadian Commission on Building and Fire Codes (CCBFC) has identified priorities that present complex technical challenges. This article, the second in a series, discusses some of the issues that are now being addressed. The following two priorities affect Part 9 of the National Building Code of Canada (NBC), titled Housing and Small Buildings, and deal with secondary suites in residential buildings and lateral loads due to wind and earthquakes.

Task Group on Secondary Suites

The Standing Committee on Housing and Small Buildings has formed a task group to evaluate the requirements that currently apply to buildings with not more than two dwelling units and will recommend revisions, if needed, to address secondary suites.

Secondary suites are smaller suites often retrofitted into existing single-family dwellings. Such suites are sometimes referred to as accessory apartments or "in-law suites." A number of provincial codes and municipal jurisdictions have requirements that apply to these suites but there is little consistency from one jurisdiction to another. The task group plans to review the requirements currently provided in provincial codes in their consideration of a possible reduction in requirements or the development of alternative solutions for secondary suites.

The task group will address the following issues:

- egress and exiting
- fire department access
- fire separation
- fire suppression
- flame spread
- fire exposure
- fire detection
- safety in use; forced entry protection
- structural stability
- indoor conditions; noise protection
- sanitation
- HVAC
- electrical safety

The task group's first meeting was held in Montreal, October 3–5, 2007.

The group plans to provide a report with recommendations to the parent standing committee by Spring 2008.

Task Group on Lateral Loads

The Standing Committee on Housing and Small Buildings has created a task group to examine the requirements in Part 9 of the NBC regarding lateral loads.

Proposed changes were developed in the last code cycle to address concerns regarding performance levels defined by Part 9 requirements for lateral loads. Compared to forty years ago, buildings today often include longer spans, more and larger openings in

New product evaluations

Company	Product Name	CCMC #	Description
Temlam Inc., A Tembec/ SGF Rexfor Company	Temlam 3100 Fb – 2.0E LVL	13284-R	Laminated veneer lumber (LVL) manufactured by laminating veneers of aspen with the grain of the veneers oriented to the length of the member. The LVL serves as an alternative material to lumber for dry service conditions.
269367 Ontario Limited	In-Wall	13285-R	Wall elements are prefabricated in modular panels, which may be produced in lengths up to 3.05 m long and standard heights of 2.52 m. There is a precast concrete panel on the exterior.
Fiberweb Inc.	Typar® MetroWrap™	13286-R	Produced from a 100% polypropylene, spun-bonded olefin fabric film and used as a breather-type sheathing membrane intended to resist the passage of water but permit the passage of water vapour.
ALMCAN Manufacturing Inc.	ALMCAN Joist Hangers, Framing Connectors, Hurricane Ties and Rafter Ties	13287-R	Joist hangers, framing connectors, hurricane ties and rafter ties with fasteners are all made from light-gauge steel and are used to transfer the loads from a supported member to the supporting member in wood-frame construction.
Fiberweb Inc.	Typar® MetroWrap™	13289-R	"Typar® MetroWrap™" (see product description above). Evaluation of product as an air barrier material within the Fiberweb Inc.-specified "Typar® MetroWrap™" air barrier system.
Intertape Polymer Corporation	"FLEX-GARD™ Aspire", "PermaGuard™", "PermaGard™" and "Dri-Shield™ II"	13292-R	Products consist of a spun-bonded polypropylene non-woven fabric with a monolithic polymer coating on one side. They are used as a breather-type sheathing membrane intended to resist the passage of water but permit the passage of water vapour.

For further information on the performance, usage and limitations of these products, as well as for other reports and listings by CCMC, see the Web Registry of Product Evaluations located at **http://irc.nrc-cnrc.gc.ca/ccmc/regprodeval_e.shtml**.

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walls, greater storey height and discontinuous storeys. Questions were raised as to whether the existing requirements still reflect appropriate minimum acceptable performance in light of these changes in design and construction.

The CCBFC recommended that the proposed changes to the provisions address resistance to wind and earthquake loads, and that these proposed changes be considered in the current cycle.

The task group's mandate is to investigate various factors related to this issue, including regions with high seismic and wind loads; anchorage and bracing; percentage of braced wall area; and limits to the application of Part 9 requirements.

The task group has met twice so far, on April 26 and July 30–31, 2007. It delivered a preliminary report in Fall 2007 and will deliver a final report and recommendations in Spring 2008 to the Standing Committee on Housing and Small Buildings.

Questions?

If you are interested in receiving more information regarding the task group meetings, in attending meetings or in making a presentation to a task group, please contact:

Canadian Codes Centre
National Research Council Canada
Ottawa, Ontario
K1A 0R6
Tel: 613-993-9960
Fax: 613-952-4040
E-mail: codes@nrc-cnrc.gc.ca

First Revisions and Errata to 2005 National Construction Codes Now Available!

The following Revisions and Errata have been issued and are now available to Code users who purchased the printed and CD-ROM versions of the 2005 National Construction Codes:

- First Revisions and Errata to the National Building Code of Canada 2005;
- First Errata to the National Fire Code of Canada 2005;
- First Revisions and Errata to the National Plumbing Code of Canada 2005;
- First Errata to the User's Guide – NBC 2005, Structural Commentaries (Part 4 of Division B).

The revisions were approved by the Canadian Commission on Building and Fire Codes. Information updates are also included to facilitate the use of the codes. Code users should contact their local authority having jurisdiction to find out if these revisions and errata apply in their province or territory.

The revisions and errata have been prepared as a set of tables, which can be downloaded from the Internet at http://irc.nrc-cnrc.gc.ca/pubs/codes/revisions_e.html.

Clients who purchased a publication on CD-ROM will be prompted with an option to download the revisions and errata which, if they accept, will then be automatically incorporated into their document.

For further information, please contact NRC-IRC's Publication Sales Department:

Tel.: 1-613-993-2463 or 1-800-672-7990
Fax: 1-613-952-7673
E-mail: IRCpubsales@nrc-cnrc.gc.ca

Canadian Codes Centre Employment Opportunities

Are you someone who knows the National Construction Codes and enjoys working in a dynamic and team-oriented environment? The Canadian Codes Centre needs you!

NRC-IRC's Canadian Codes Centre is seeking Technical Advisors to work with a team of professionals dedicated to maintaining and updating the National Construction Codes. The positions available relate to Fire Safety and Occupancy as well as the recently announced updating of the Model National Energy Code for Buildings.

More information regarding these positions and NRC's on-line job application process is available at www.nationalcodes.ca.

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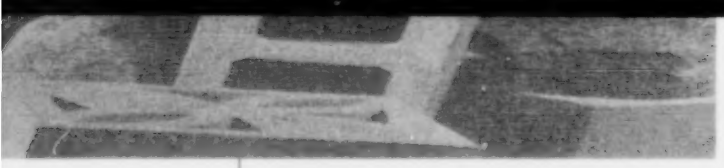


CCMC product evaluations evolve in response to requests from industry and changes in the 2005 National Building Code

The Canadian Construction Materials Centre (CCMC) has been evaluating construction products and systems since 1988. In 2005 a number of things happened that resulted in significant changes to the CCMC evaluation process, which are expected to be of great benefit to manufacturers, building officials and evaluation officers.

Responding to changes to the NBC in 2005

The reorientation of the national model building code (NBC 2005) to an objective-based format has had a major impact on the CCMC evaluation process. This code is structured around objectives—the overall goals that the codes provisions are intended to achieve—and functional statements—the functions a building must perform to fulfill the objectives. Section 1.2 of Division A clarifies that compliance can be achieved either by meeting the requirements embodied in the code's "acceptable solutions" (essentially the technical provisions of the code) or by using "alternative solutions" that meet the minimum level of performance of acceptable solutions.

In earlier versions of the NBC, the Equivalents section (the basis for CCMC evaluations) allowed for a broad interpretation of a code requirement. The NBC 2005 goes further than this by linking at least one objective and a functional statement to each code requirement, thus providing the user with more specific background information on requirements as well as guidance on how to evaluate the performance of innovative products and systems. This, in turn, provides a more precise tool for determining conformance, thus facilitating the uptake of innovation.

What is an evaluation?

The CCMC evaluation of products or systems is an impartial third party technical opinion on the compliance of a product or system to the NBC 2005 (or provincial code). Innovative products are evaluated as an alternative to (a) code-identified solution(s) in NBC Division B. Each CCMC evaluation is a proponent-specific undertaking to establish compliance with the regulatory requirements in force in the jurisdiction where the approval is being sought.

A successful evaluation results in a report that states CCMC's opinion with regard to the product's/system's performance and its compliance with the minimum acceptable solution stated in the NBC. This opinion is based on the test evidence submitted in accordance with these requirements. Limitations are set based on the scope of the evaluation, the code and the evidence submitted.

Evaluation process

Major components of the evaluation process	New activities	Benefits
Application supported by technical information	Applicant to define area of interest and code-related context.	More client focused and technically specific. Facilitates a more efficient process.
Scope and evaluation plan	Code analysis to identify what the code requires.	Technical requirements and criteria focused on the code requirements.
Technical guide	Requirements linked to code or code-acceptable solutions in Division B. Requirements linked more closely to NBC through new guidelines.	Requirements aligned with functional and objective statements of NBC 2005. Provides acceptable or alternative solution to code. Where an alternative solution to the code is sought, Division B performance solutions will be used to set the criteria. Additional health and safety issues identified by other agencies will be identified and included as a separate section.
Assessment of the test results	No change.	
Report	New format designed to facilitate decision making.	The NBC opinion statement at the front of the report is supported by submitted evidence. Additional and optional information may be included but will not form part of the opinion.

As part of the evaluation process, a technical guide, which is prepared for an innovative product for which no standard exists, conveys CCMC's criteria and requirements to facilitate the assessment. A technical guide, when issued under contract, is proponent- and product-specific, and is valid for one year (i.e., CCMC will accept test results for a period of one year from date of issue). In order for CCMC to issue a report and an evaluation number, the proponent not only has to meet the technical requirements but also other requirements, such as those related to sample selection, ISO 9000 registration or evidence of a quality assurance program, as outlined in the technical guide.

The issuance of a CCMC report and evaluation number does not constitute an approval or a certification of the product or system. Regulators, specifications writers, builders or general users can use the information to determine approval or acceptability.

The NBC 2005 addresses the issue of what documentation is required to demonstrate compliance for alternative solutions in Division C, Section 2.3. While this section provides guidance, it does not provide information on how to determine the minimum acceptable solution. CCMC's revamped evaluation process assists in the evaluation of products and systems with regard to code compliance.

The revamped evaluation process assists CCMC in evaluating products and systems with regard to code compliance.

Responding to industry needs

CCMC's response to industry requests to re-examine the evaluation guidelines has also had a major impact on the evaluation process. As a result of these requests, CCMC consolidated its existing guidelines to align more closely with the explicit requirements of the NBC, and also eliminated suitability-for-use expectations (see *Construction Innovation*, March 2005). In the new streamlined evaluation process, the subjectivity has been removed and the requirements are clearer, making it easier for proponents to know up front what they will be facing, for evaluation officers to conduct the evaluation in a more focused way, and for building officials, who no longer have to distinguish between code minimums and suitability-for-use performance.

For more information about CCMC go to http://irc.nrc-cnrc.gc.ca/ccmc/home_e.shtml.

Call for candidates to serve on the CCCME

The National Research Council (NRC) is seeking candidates to serve on the Canadian Commission on Construction Materials Evaluation (CCCME).

The CCCME was established by NRC to provide policy advice on all matters pertaining to the operation of the Canadian Construction Materials Centre (CCMC) and to ensure the reliability and quality of technical decisions and reporting.

CCMC offers a national evaluation service for innovative construction materials, products, systems and services used in commercial and residential buildings. Operating as part of the National Research Council Institute for Research in Construction (NRC-IRC), CCMC evaluations are based on the requirements of the National Building Code of Canada and are supported by the latest technical research and expertise.

CCCME members are selected from a mix of backgrounds to ensure that the Commission can address both policy and technical issues in a manner representative of the different regions of Canada, sectors of the construction industry, and users of the evaluation, technical information and listing services offered by CCMC. Members are expected to exercise broad objective judgments and are chosen for their individual interests and abilities rather than as delegates or representatives of any particular association or group. They are not permitted to name alternates.

CCCME members are appointed by NRC. Such appointments do not carry remuneration, but travel and accommodation expenses incurred in attending Commission meetings, typically held once a year, are reimbursed by NRC. The term of appointment is normally three years; however, members may be re-appointed for further terms subject to maintaining a reasonable degree of membership rotation. New appointments and re-appointments will be effective November 1, 2008.

The Commission is currently seeking representation from the following sectors:

Regulatory	Provincial, territorial and municipal building officials, municipal administrators
Manufacturing	Members of the private sector involved in the manufacture of building materials, products and systems
Major Users	Architects, engineers, contractors, specification writers, and private and federal agencies with an ownership mandate
General	Those associated with the construction industry in an independent capacity, which may include independent research, testing and certification agencies.

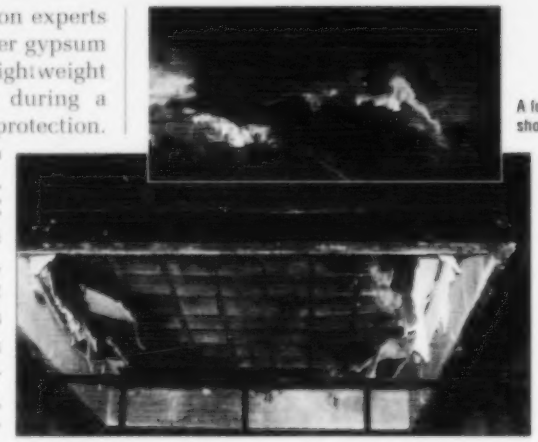
Those interested in serving on the Commission should submit a résumé with details of their personal history by January 31, 2008 to:

Mrs. H.V. Roche, P.Eng.
Secretary, CCCME
Institute for Research in Construction, Building M-24
National Research Council of Canada
1200 Montreal Road
Ottawa, Ontario K1A 0R6
Fax: 613-952-0268
E-mail: **helene.roche@nrc-cnrc.gc.ca**

For more information on CCMC and CCCME please go to:
http://irc.nrc-cnrc.gc.ca/ccmc/index_e.html

Research investigates factors affecting gypsum board fire protection in rated floor assemblies

For some time, construction experts have known that the longer gypsum board stays in place in lightweight framed floor assemblies during a fire, the better the fire protection. To determine how to maximize this effect, researchers at the NRC Institute for Research in Construction (NRC-IRC), working with government and industry collaborators (see sidebar), have been studying the fire resistance of floor assemblies, focusing in part on the key parameters that could affect the time it takes for gypsum board to fall off during a fire.



A full-scale floor assembly under fire conditions showing gypsum board falling off.

Gypsum board provides significant fire resistance protection to building assemblies because of its non-combustible core, composed of 21 per cent water (by weight). This fire resistance, however, depends heavily on how long the gypsum board remains in place to protect the framing.

The NRC-IRC researchers looked at the results of 80 full-scale floor assembly tests under fire conditions. They constructed the assemblies using combinations of several components, including solid wood, wood I-joists, steel C-joists, wood trusses, plywood sub-floors and steel deck sub-floors with concrete topping. The researchers then evaluated a number of parameters, including the number of layers of gypsum board, the type of framing, the installation and spacing of resilient channels, the type and installation of insulation, and the method of fastening the gypsum board to the framing or the resilient channels.

In general, the researchers found that:

- Gypsum board fall-off time has a significant effect on the fire resistance of lightweight frame assemblies; the longer the gypsum board stays in place the better the fire resistance.
- A second layer of gypsum board increases the fall-off time for the gypsum board layer exposed to the fire (face layer) compared to an assembly with only one layer of gypsum board, even though the base layer falls off quickly once the face layer has dropped off.
- The type of framing has no significant effect on gypsum board fall-off time.
- Adding concrete topping to the deck increases the fall-off time for the face layer (but not for the base layer) and consequently increases the fire resistance.
- The installation of resilient channels does not affect the fall-off time for gypsum board compared to an assembly without resilient channels. However, changing the spacing of the resilient channels from 406 mm to 610 mm has a negative effect on the fall-off time, while changing the spacing from 406 mm to 203 mm has no significant effect.
- The presence of insulation in the floor cavity has a negative effect on the fall-off time of gypsum board for assemblies with both one and two layers of gypsum board.
- An increase in gypsum board screw spacing from 10 mm to 38 mm from the board edges increases the fall-off time considerably.

In the future, the NRC-IRC researchers plan to do further studies to better understand why the presence of insulation in the floor cavity has a detrimental effect on gypsum board fall-off time.

For more information about this study, please contact Dr. Mohamed Sultan at 613-993-9771, fax 613-954-0483 or e-mail mohamed.sultan@nrc-cnrc.gc.ca, or visit the Web site at http://irc.nrc-cnrc.gc.ca/pubs/fulltext/nrcc45420/.

Project partners

Boise Cascade (U.S.), Canadian Home Builder Association, Canada Mortgage and Housing Corporation, Canadian Portland Cement Association, Canadian Steel Construction Council, Canadian Wood Council, Cellulose Insulation Manufacturers Association of Canada, Cellulose Insulation Manufacturers Association (U.S.), Forintek Canada Corporation, Gypsum Association (U.S.), Gypsum Manufacturers of Canada, Johns Manville International (U.S.), Louisiana-Pacific Corporation (U.S.), Nascor Inc., Ontario New Home Warranty Program, Ontario Ministry of Municipal Affairs and Housing, Owens-Corning Canada, Roxul Inc., Trus Joist MacMillan (U.S.), Truss Plate Institute of Canada, Truss Plate Institute (U.S.) and Willamette Industries (U.S.)

Study looks at cold weather protection of repair mortars

A study conducted by NRC-IRC and Public Works and Government Services Canada (PWGSC) has yielded benefits in terms of cost savings and practical considerations for projects related to masonry conservation on Parliament Hill, where the window of opportunity for carrying out repair work during warm weather is short.

Masonry conservation work involving repointing with low-strength mortars (in the range of 2–7 MPa) should ideally be carried out well before winter sets in, with the initial period of cure for the fresh mortar occurring in a warm and humid environment to ensure long-term durability. However, in practice, project completion may stretch into late fall/early winter.

In 2001 the specifications used by the Heritage Conservation Directorate (HCD) of PWGSC included a requirement for heating enclosures to be set up around the work area for 28 days after the application of the fresh mortar. HCD requested that NRC-IRC researchers assess whether the duration of cold weather protection could be reduced without negatively affecting the durability and frost resistance of traditional masonry assemblies.

The researchers conducted a laboratory study to characterize the freeze/thaw resistance of one mortar mix predominantly used for repair work on Parliament Hill—a low strength Portland cement-lime mortar mix. Based on the findings of this study, the period of protected curing in cold weather for this mortar mix can be safely reduced from 28 days to seven days by following a prescribed protocol developed for this purpose. (Further research is required to determine whether these recommendations can be applied to mixes other than the low-strength repointing mortar mix typically used on Parliament Hill.)

Flag pole structure on the Vaux wall of Parliament Hill (left); the same structure with heating enclosure in place following the application of fresh mortar (right).

Protocol for cold weather protection of masonry

A seven-day period of moist curing at controlled temperature and relative humidity should be provided in the following manner:

- For the first three days, the masonry should be maintained at a temperature above 10°C and moist conditions near the surface of the masonry (not in contact) should be maintained by using damp burlap covered with a plastic membrane.
- For the next four days, the masonry should be protected against wind and rain while keeping the temperature above 0°C.
- The relative humidity level should be kept high (above 50%) within the heated enclosure to avoid premature drying of the mortar (heating cold air has the effect of lowering its relative humidity).

After seven days of curing the heat can be turned off, but the repointed masonry should be protected from the weather for as long as is practically possible—particularly from rain or melting snow.

The project team emphasizes that every effort should be made at the planning stage to avoid winter work for this type of application before considering the option of cold weather protection. However, circumstances may lead to unavoidable delays. Subsequently, when this protocol was followed on some HCD projects that stretched into early winter, the results were satisfactory. Reducing the duration of the requirements for heating temporary enclosures from 28 days to seven days was estimated to have saved about $150/m^2 of repaired wall.

Details of the study can be found at http://irc.nrc-cnrc.gc.ca/pubs/fulltext/nrcc47719/, and specific questions can be directed to Ken Trischuk at 613-990-6438, fax 613-998-6802, or e-mail ken.trischuk@nrc-cnrc.gc.ca.

Best practice guide for fire stops and fire blocks now available

After three years of development, a new best practice guide on fire stops and fire blocks has just been completed by a large group representing a broad cross-section of the construction industry. This group includes manufacturers of fire-stop products, industry associations for construction materials other than fire stops, and regulatory and certification agencies, together with organizations such as NRC and CMHC that provide technical information to the industry. (See sidebar for full list of participants.)

Designers and builders ... must use a systems approach that meshes the requirements for both sound and fire control for fire stops and fire blocks.

Fire resistance and sound transmission ratings are now available for a broad range of wall and floor assemblies. However, in addition to choosing suitable assemblies based on these ratings, designers and builders need to be able to ensure satisfactory performance of complete building systems—that is, they must use a systems approach that meshes the requirements for both sound and fire control for fire stops and fire blocks. (For definitions of these terms go to http://irc.nrc-cnrc.gc.ca/ie/acoustics/sigsaft/terminology_e.html).

The issue of achieving satisfactory system performance, along with other issues such as that of differences between Canadian and U.S. testing procedures and regulations, led to a joint initiative between NRC-IRC and Ken Richardson Fire Technologies in 2004. This in turn led to the formation of a Special Interest Group that has developed the guideline document, with one of its main goals being the establishment of broad consensus on terminology and good practice to promote consistent handling by building officials during the approval stage.

The Guide, which represents a synthesis of available information, primarily addresses fire stops and fire blocks in the context of Canadian codes and standards. Requirements for fire stops and fire blocks in the National Building Code of Canada (NBC) are similar in concept to those in U.S. codes, but specific significant differences between Canadian and American codes, standards and terminology are identified. The Guide also identifies differences between the NBC and provincial building codes.

While the Guide makes extensive reference to the NBC as the source of requirements for fire stops and fire blocks in Canada, there are situations where best practice may dictate the need for features that go beyond the code requirements. These are addressed in many examples in Chapters 7 through 13, which illustrate (with the help of 150 AutoCad drawings) good practice for fire stops at junctions and penetrations, and provide guidance on the corresponding acoustical issues, such as noise leaks, plumbing noise, and structure-borne sound transmission.

Ultimately it is up to the authority having jurisdiction to decide on the acceptability of a solution, but it is expected that the Guide will promote more informed and consistent practice across Canada regarding fire stopping techniques.

You can find the Guide, as well as more background information, at http://irc.nrc-cnrc.gc.ca/ie/acoustics/sigsaft/index_e.html.

Specific questions can be directed to Dr. David Quirt at 613-993-9746, fax 613-954-1495, or e-mail dave.quirt@nrc-cnrc.gc.ca.

Participating organizations in the Special Interest Group for Suitable Acoustic and Firestop Technologies include 3M Canada, A/D Fire Protection Systems, Affinity Architecture Inc., Bibby-Ste-Croix Inc., Canada Mortgage and Housing Corporation (CMHC), Canadian Copper & Brass Development Association, Canadian Wood Council, The City of Calgary, Gypsum Association, IPEX Inc., Ken Richardson Fire Technologies Inc., North American Insulation Manufacturers Association (NAIMA), National Research Council Canada (NRC), NUCO Inc., Cobri Technologies Inc. (formerly Royal Quickstop), Tremco Inc., Hilti Inc., and International Firestop Council (IFC). The project was managed jointly by NRC-IRC and Ken Richardson Fire Technologies Inc.

New NRC-IRC expertise to tackle productivity in construction sector

The recent realignment of NRC's research programs and resources will bring NRC-IRC a number of experts from the NRC centre in London, Ontario. These researchers will add valuable expertise in modelling, artificial intelligence, virtual engineering, software engineering and human/computer interaction to the institute's existing skill set.

The groups' first task will be to develop and apply information technology-based tools to help the construction industry tackle the major challenge of productivity. Rising input costs, global competition, demand for faster results and a shortage of skilled labour all mean that the construction industry needs to find new and innovative ways to enhance its performance. New IT tools should give Canadian companies a competitive edge in the sector by increasing efficiency and profitability.

This cross-disciplinary approach to problem solving is part of NRC's new corporate strategy called Science at Work for Canada. As part of this strategy, NRC is emphasizing interdisciplinary collaboration and increasing efforts to support industry in key sectors, such as construction (see *Construction Innovation*, June 2007). Specifically, NRC is working to develop highly valued technologies and transfer them to industry, increase innovation and commercialization support to industry, and align research and development priorities with industry needs.

The groups will remain at NRC's facilities in London, which will help NRC-IRC build a stronger presence and foster partnerships in Southern Ontario, one of Canada's most active areas for the construction industry.

For the complete text of NRC's corporate strategy, go to http://www.nrc-cnrc.gc.ca/aboutUs/corporatereports/strategy/strategy_e.html.

Guidelines for effective solar shading of residential windows to be developed

Recent Natural Resources of Canada statistics estimate that the energy demand for heating and cooling accounts for about 63% of the total energy consumption of an average Canadian home. Although the overall demand for cooling energy is much lower than for heating, many populated areas experience peak demand for electricity on summer afternoons.

Effective solar shading devices include operable exterior insulating blinds and highly reflective interior shading. Both have the potential to reduce solar overheating in summer and heat losses in winter, and to improve the thermal comfort of occupants seated near windows. Exterior shading, although not common in Canada, outperforms interior shading. The latter, if not properly designed and installed, may increase the potential risk of condensation and excessive glass thermal stress. This is particularly true when interior shading is used with insulating glass units, which feature low-emissivity coatings and inert gas fills.

NRC-IRC researchers are initiating a two-phase project to investigate the potential for solar shading in houses to 1) reduce the energy needed for heating and 2) reduce or eliminate the need for cooling without adversely affecting occupant thermal comfort and window durability. The first phase will develop guidelines for the effective use of solar shading for windows in houses, and will address the following issues:

- thermal peak loads and energy consumption of new and retrofitted Canadian houses
- energy costs and paybacks
- thermal comfort of occupants
- potential risk of condensation and thermal stresses on windows.

In addition, the project will gather information on how homeowners use shading, as well as on the types of controls involved, and assess how these factors affect energy demands.

To study the effects of shading, researchers will use both state-of-the-art computer simulation tools and measurements at the Canadian Centre for Housing Technology (CCHT) research facility. They will also devise a Web-based survey to investigate the way in which occupants use shading.

The second phase of the project will involve a field demonstration of motorized solar shading to evaluate the integration of shading controls with house heating and cooling systems.

NRC-IRC is seeking partners to participate in this project. For further information, please contact Dr. Aziz Laouadi at 613-990-6868, fax 613-954-3733, or e-mail aziz.laouadi@nrc-cnrc.gc.ca.

Project leads to new aging method for pavement sealants

Cracks in roadways can grow incrementally as a result of seasonal variations in temperature, weathering and traffic. If left untreated, these cracks develop into networks of cracks and potholes, shortening the life expectancy of the roadway. Like the painting of scratches and the rust proofing that extend the life of a car, the sealing of cracks in pavement delays its deterioration, hence saving their owners money in the long run.

Because extending pavement service life requires using the right high-quality crack sealants, researchers at NRC-IRC initiated a consortium to create performance guidelines to help owners select appropriate sealants (see *Construction Innovation*, March 2006, http://irc.nrc-cnrc.gc.ca/pubs/ci/v11no1/v11no1_9_e.html). One of the consortium's main goals was to develop an effective accelerated aging test for sealants, which are complex mixtures that often contain bitumen, oil, polymer, ground tire rubber and mineral filler.

For an aging test to be effective, it must provide rapid aging that replicates reality as closely as possible. Thus before the effectiveness of an accelerated aging test could be established, true aging (weathering) had to be determined from the physico-chemical analysis of twelve sealants weathered in the field for nine years.

To mimic the effect of weathering on sealants, several accelerated aging methods were compared (alone or in combination) for various times and temperatures. These methods included small-kettle aging, microwave aging, pressure aging, oven aging, and vacuum oven aging. The researchers compared the results of the analysis of sealants weathered in the field to those for the sealants aged in the laboratory. The oxidation of the sealant bitumen, the change in the polymer structure and molecular weight, and the change in sealant stiffness between -40°C and 40°C all served to validate, or invalidate, the accelerated aging methods.

The results showed that microwave heating could mimic the aging of sealants containing mineral filler but not of other types of sealant, and thus lacked general applicability. They also demonstrated that pressure aging was inadequate, as it often led to insufficient bitumen oxidation but excessive thermo-degradation of the polymer. Of all the methods, vacuum oven aging was found to be the most effective method of simulating sealant weathering.

Articles on the subject of sealant, bitumen and polymer-modified bitumen may be found in the NRC-IRC database. Visit http://irc.nrc-cnrc.gc.ca/ircpubs/search2.html and click on "crack sealants."

NRC's green and gold building

Continued from cover page

Similarly, the use of these technologies prompted the development of unprecedented detailed safety procedures and extensive fire detection and mitigation systems for an inhabited building using innovative hydrogen technologies. Given that hydrogen is highly flammable, the fire control systems are particularly important and include high-ceiling hydrogen gas detectors, gas evacuators, flame detectors (because flaming hydrogen is invisible to the human eye), and automatic window openers. The experience gained from both the safety procedures and the fire control systems is important to further research in the field if fuel cell technologies are ever to be considered for mass-market use in other green buildings.

To learn more about the NRC-IFCI facility, or for more information on demonstrating a building-integrated environmental technology, contact David Semczyszyn, NRC-IFCI's Director of Operations and Technology Demonstration, at 604-221-3013, fax 604-231-3001, or e-mail david.semczyszyn@nrc-cnrc.gc.ca.

Happy on the inside

When NRC-IFCI drew up the plans for its new facility a few years ago, they harnessed the collective know-how of the Cost-effective Open-Plan Environment (COPE) Project. COPE was a consortium led by NRC-IRC that brought together researchers in engineering, acoustics, psychology, indoor air quality, architecture and lighting. COPE research showed how to design an open-plan office to provide environmental satisfaction for its occupants, and demonstrated that this is an important contributor to organizational productivity.

By all accounts, this approach at NRC-IFCI has been a success. The building boasts equally sized open-plan offices for most employees regardless of level, and outside light that penetrates deep into the office space. It also has environmental elements that employees can control, such as task lighting, windows that open and thermostats that can be adjusted.

"People have been pleasantly surprised with the work space in the new building," says David Semczyszyn, NRC-IFCI's Director of Operations and Technology Demonstration. "It's less cloistered. The light energizes the space. And the office design promotes better communication."

For more information on COPE, go to http://irc.nrc-cnrc.gc.ca/ie/lighting/workplace/index_e.html.

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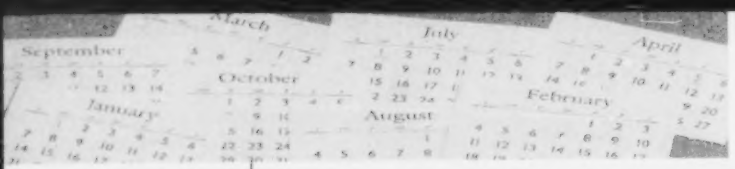

Upcoming events

2008

JANUARY

17

21st Meeting of the NRC-IRC Working Group on Repointing Mortars. Ottawa. http://irc.nrc-cnrc.gc.ca/bes/hmpe/masonry/mortar/mortar_e.html

22-24

International Air-Conditioning, Heating, Refrigerating Exposition (AHR Expo). New York. http://www.ahrexpo.com/

FEBRUARY

4-5

Meeting of the Task Group on Secondary Suites. Ottawa. Contact: Nedjma Belrechid at 613-990-8457, e-mail: Nedjma.Belrechid@nrc-cnrc.gc.ca

13-14

British Columbia Construction Show. Vancouver. NRC-IRC is a participant in this event. You are invited to visit our booth #1607 for more information about our research expertise. http://www.bcconstruct.com/

24-25

20th Meeting of Canadian Commission on Building and Fire Codes. Montreal. Contact: Anne Gribbon at 613-993-5569, or e-mail anne.gribbon@nrc-cnrc.gc.ca.

MARCH

30-April 3

American Concrete Institute Spring Convention. Los Angeles. http://www.concrete.org/EVENTS/EV_CONVENTIONS.HTM

MAY

11-14

11th International Conference on Durability of Building Materials and Components. Istanbul. http://www.11dbmc.org/

JUNE

16-18

PAQS 2008—Construction in Challenging Environments. Edmonton. http://www.paqs2008.com/papers.php

24-26

World Wind Energy Conference. Kingston, ON. http://wwec2008.com/

25-28

7th Annual International Conference on Managing Pavement Assets (ICMPA). Calgary. http://www.icmpa2008.com

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Go to **www.bsi.gc.ca** for further information about registration and location.

Fire Safety Research for Better Building Design

January 15
Fredericton*

January 24
Ottawa*

February 5
Calgary

February 7
Toronto

February 19
Quebec City (in French)

February 21
Montreal*

* With simultaneous translation

This calendar does not include all events scheduled to take place during this time frame. For a more complete listing, see the Web version of "Upcoming events" at http://irc.nrc-cnrc.gc.ca/events_e.html

construction *innovation*

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